Western Region
Energy-Water Needs Workshop
Executive Summary

Background

The Western Region Workshop is part of the initial information-gathering phase for a National Energy-Water Technology Roadmap process [see Figure-1] initiated in late-FY2005. The purpose of the roadmap is to provide guidance for U.S. Department of Energy (DOE) program development in the area of energy and water interdependency. The phrase used to describe the critical interdependency of energy and water is "Energy-Water Nexus. DOE was recently authorized and directed by the Energy Policy Act of 2005 to establish a program to address Energy-Water Nexus issues. The current roadmap effort is funded out of FY2005 appropriations and will be completed by the end of FY2006. Additional information on the Energy-Water Nexus and a related Report to Congress can be found at http://www.sandia.gov/energy-water.

The roadmap will identify and address critical energy-water nexus needs and issues that may not be receiving adequate attention by other energy programs within DOE or water programs within other federal agencies. The findings and recommendations of this initial Energy-Water Roadmap will assist the DOE in defining the directions and priorities for science and technology research, development, demonstration, and commercialization efforts needed in the future in this area. The goal is to insure that:

(1) Energy-related issues associated with providing adequate supplies, optimal management, and efficient use of water, and
(2) Water-related issues associated with providing adequate supplies, optimal management and efficient use of energy,

will both be effectively addressed in a manner that complements other energy programs within DOE and other water-related programs within other Federal agencies.

The roadmap process is designed to be "needs-driven" and based on broad user and stakeholder community input. The initial phase of the process consisted of information gathering accomplished by holding a series of "needs assessment" workshops in different regions of the country. Each workshop involved participation by representatives from a broad range of invited user and stakeholder communities that included water and energy resource planners and managers, energy production and power generation organizations, environmental organizations, policy and regulatory interests, economic development interests, industry/supplier associations, government agencies (federal, state, tribal), non-governmental organizations, science and technology providers (industry, national laboratories, universities, research institutions), and other knowledgeable stake-holders from across the country.

The information gathered through the regional workshops provides input to a "gap analysis" being conducted during the February-March time-frame. The gap analysis focuses on linking and quantifying specific technology gaps associated with the needs and issues identified during the regional workshops. The gap analysis results provide information and guidance needed for

the planning and implementation of a Technical Approaches & Innovations Workshop scheduled for early-May. The results of these various roadmap activities will then be integrated into the Roadmap Report that summarizes the findings and recommendations for the direction and prioritization for future DOE investments in Energy-Water science and technology research, development, commercialization, and implementation. The report is expected to be published by DOE in the September-October 2006 time-frame.

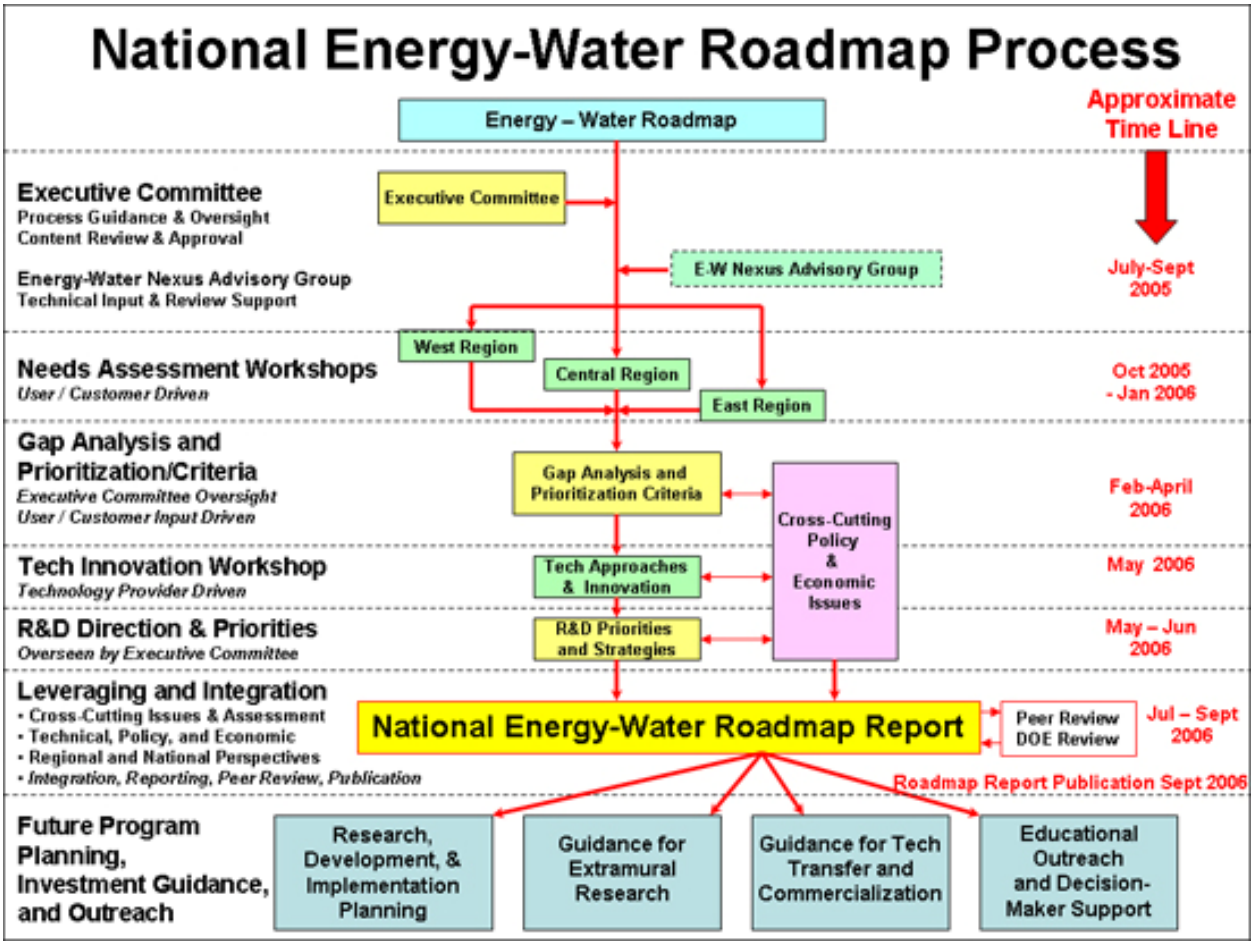

Figure-1. Overview of Energy-Water Technology Roadmap Process and Schedule

Objectives

The objectives of the regional needs workshops were to identify current and future problems, needs, and critical issues associated with energy-water interdependencies within each region that, when combined, also provides a broader cross-cutting needs and issues framework for the national Energy-Water Roadmap. The regional workshop locations were selected to help facilitate and promote broad participation from the various states within each region. Workshop focus was on identifying and characterizing the major problems and needs related to energy and water technologies, policy, regulation, competing use sector demands, and other related economic and environmental factors. A limited amount of workshop time was also allotted to some discussion of gaps and potential solutions, although these topics are being addressed much more thoroughly in later phases of the roadmap process (see Figure-1).

Approach

The Western Region Energy-Water Needs Assessment Workshop was held January 9-11, 2006, in Salt Lake City, Utah. It was the last of three information-gathering workshops held across the country during the mid-November 2005 to mid-January 2006 time-frame. Others were held earlier for the Central and Eastern Regions. Each workshop was a 2-day event (with check-in, registration, and a social mixer on the evening before) with a limited amount of formal presentation that included some regional issues content. However, most of the workshop schedule was devoted to facilitated small group breakout sessions.

The breakout sessions provided the opportunity for smaller-group interaction and discussion to identify and explore a broad range of issues and needs surrounding water & energy interdependencies. The workshops were professionally facilitated and offered a valuable opportunity for participants to join a diverse group of knowledgeable colleagues invited to share ideas and contribute critical thinking on energy-water issues and needs from a local, regional, and national perspective.

Candidate participants representing diverse backgrounds, expertise, perspectives, organizational affiliation, and demographics were identified, contacted, and invited to attend. The workshops were designed with flexibility to allow accommodation of from 70-to-140 participants. Categories of invited stakeholder participants for each workshop included:

- Energy/Power/Utilities (energy mineral extraction, fossil & bio-fuels production, electric power generation)
- Water Utilities/Water Managers/Water Planners
- Environmental/Ecological Interests
- Regulatory/Policy Interests
- Economics & Economic Development Interests
- Other Major Energy & Water Use Sectors (Agricultural, Mining, Industrial)
- Special Interests, Tribal, State Government Associations, and others
- Science & technology providers (Industry, Universities, Nat'l Labs, etc.)

Methodology

The workshop participants were divided into six breakout groups. Over the course of two days, each breakout group participated in four breakout sessions that explored energy and water interdependency problems, needs, and potential solutions. The breakout sessions used a series of questions and Workshop Matrices to help guide the facilitated discussion process. The same questions and matrices were used in each of the three regional workshops. The steps can be summarized in the following bullets and are illustrated in Figure-2:

- Identify near-term and longer-range problems, issues, and concerns at the state, regional, and national level regarding the interdependencies of energy and water;
- Define the short and long-term energy supply and water supply needs in terms of the major problems, issues, and concerns identified;

- Share ideas for potential solutions and opportunities for addressing the problems and needs, even though this was not the primary focus of the needs workshops.

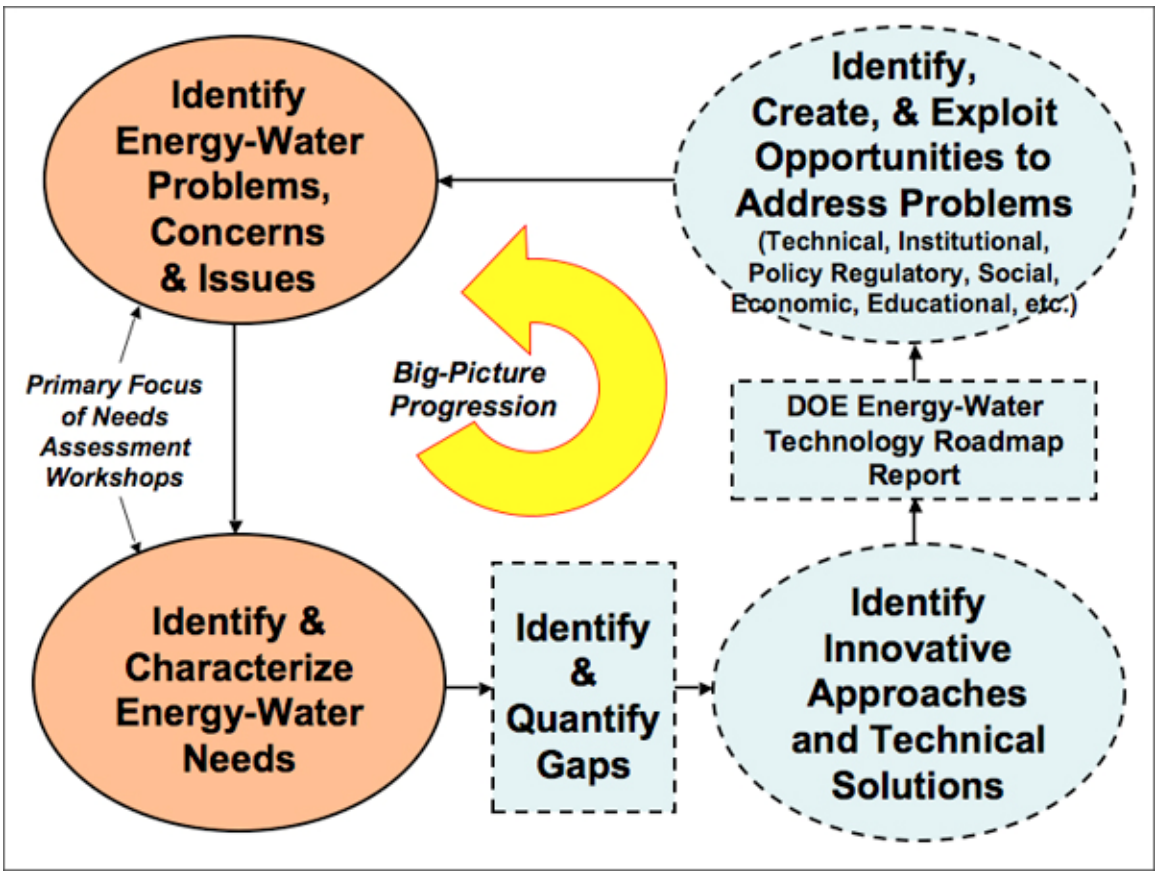

Figure-1. Overview of Energy-Water Technology Roadmap Process and Schedule

The progression of the breakout session discussions was intended to identify the "big picture" problem areas first. Once these areas were discussed and identified, specific needs (requirements) associated with these problem areas could be identified. Finally, although the focus of the workshop was on identifying critical problems, needs, and issues, the last session afforded the opportunity for participants to explore and suggest potential solutions and opportunities to address the problems and needs identified earlier.

The process was illustrated by the lead facilitator through the following simple example:

- **Problem:** My grades and SAT scores are not good enough to get me into the college of my choice.

- **Needs & Gaps:** I need to improve my grades from a 'C' average to at least a 'B' average (Gap 1), and I need to improve my SAT score from a 1000 to a 1200 (Gap 2).

- **Solutions & Opportunities for Application:** I will…
  - Take an "Effective Study Habits" course (addresses Gap 1)
  - Enroll in an SAT review course (addresses Gap 2)

- Stop watching too much TV (addresses both Gaps 1 and 2).

Overview

The Western Workshop began with welcome, introductions, and a statement from Senator Pete Domenici (R-NM), Chairman of the Senate Energy and Natural Resources Committee. In his statement delivered by Staff Member Erik Webb, Senator Domenici conveyed the importance of the workshops and the DOE roadmap process to address problems and needs associated with the interdependencies of energy and water. Senator Jeff Bingaman (D-NM), also provided a letter of support.

An overview presentation was given by Ron Pate from Sandia, followed by four presentations from a regional speakers' panel consisting of Robert Goldstein (Electric Power Research Institute), John Maulbetsch (Maulbetsch Consulting), Susan Innis (Western Resource Advocates), and Norm Whittlesey (Professor Emeritus of Agricultural Economics, Washington State University). A luncheon presentation was provided later on the first day by Martha Krebs from the California Energy Commission and on the second day by Michael Gabaldon from the US Bureau of Reclamation. The various presentations and associated QA discussion provided relevant background information and brought out specific regional characteristics associated with to the interdependencies of energy and water in the western states.

Workshop participants were each assigned to one of six smaller breakout groups. Following the morning presentations, the lead facilitator (Conrad Mulligan from McNeil Technologies) briefly described the workshop process and provided the ground rules and instructions for the participants prior to dividing up into the small-group breakout sessions. Each group was formed to have broad representation from among the various categories of participants (utilities, regulatory/policy, environmental, etc.) in attendance. The formation of the six breakout groups was done to promote more interactive group discussion among the participants, and to facilitate the exploration and capture of a broad range of problems, needs, and issues within and across the different groups.

For the remainder of the first day, each breakout group focused on problems and issues associated with energy (Session 1), and with water (Session 2). The breakout groups reconvened at the end of the first day and a representative from each group highlighted their findings from Sessions 1 and 2. On the second day, the breakout groups focused on the identification of needs (Session 3) associated with the problems and issues identified on the first day. The final breakout session (Session 4) on the second day allowed participants to suggest opportunities and potential solutions to address the identified problems and needs. At the end of the second day, a representative from each breakout group summarized the major findings for Sessions 3 and 4. A list of participants belonging to each breakout group is provided in the *Results* section below. The matrices and questions were used by the facilitators to help guide discussion in each breakout session.

Results

The Western Workshop was attended by approximately 143 participants representing eleven of the thirteen Western-Region states. Participants from ten other states outside the Western

Region were also present. Included were several representatives from the DOE Energy-Water Roadmap Executive Committee and representatives from the multi-laboratory Energy-Water Nexus Team.

The following is a synopsis of Western Region Workshop Results:

Water Availability

- Need: Analysis of tradeoffs between water efficiency and thermal efficiency
- Need: Better assessment of resources
    - Comprehensive system including data and maps covering energy systems, water resources, ownership, controls or river habitats
- Need: Identify and map recharge areas
- Need: Identify potential water resources not in use
- Need: RD&D on recharge and recovery technologies
- Need: Identify/quantify potential conservation in various sectors
- Need: Assess and characterize bioenergy water demands
- Need: Development of remote sensing technologies for water resource assessments.

Water Cost/Value

- Need: Research on common metrics to value externalities (cultural/environmental)
- Need: Research on uses of water versus value of water
- Need: Analysis of pricing policies and impacts on energy/water conservation
- Need: Research on metrics to help establish true value of clean water
- Need: Better standards and methodologies for decision support system to capture full value of water.
- Need: Research to develop predictive model for long-term value of water
- Need: Real-time monitoring data

Produced water

- Need: Reduce treatment costs for produced water
    - R/O filtration cost reduction
    - Improve membrane efficiencies
- Need: Quantify CBM produced water volumes
- Need: RD&D on technology solution to disposal/use of produced water
- Need: Develop materials and equipment that allow use of produced/low quality water in industrial processes

Water intensity of thermoelectric cooling

- Need: Develop technologies for more efficient water use in energy producing industries
- Need: DOE provides rate relief/preapproval/federal incentives for implementation of more water efficient technologies
- Need: Demonstrations and first-commercialization of more water efficient technologies

Integrated Resource Planning

- Need: Research on hydropower impacts on water systems and ecosystems
- Need: Understand the impact of water cost on energy price
- Need: Integrated assessment of interaction between water and energy
- Need: Better RD&D coordination among major players in water and energy research (AWWA, EPRI, etc.)
- Need: Information and analysis of complexity of overlaying authorities, regulations and policies
- Need: Develop models/decision support tools for truly integrated systems (air, water, energy)
    - Need: Consistent, uniform datasets to feed models

- Need: DOE supports translational (interdisciplinary) science programs that integrate water/energy science with decision makers
- Need: Define scale of 'hydrographic neighborhoods'
- Need: Analytical tools that incorporate water/land
- Need: Integrated measurement and monitoring system
- Need: Demand forecasting tools
- Need: Consistent data standards

Conservation programs

- Need: Compile case studies of successful conservation programs (e.g. evapotranspiration monitors for irrigation)
- Need: Federal requirements/regulations for standardized energy-efficient systems/technologies to be used by commercial and residential customers
- Need: Scientific/technical bases for development of Federal water efficiency standards
- Need: "WaterStar"
- Need: Federally-supported innovation contests/programs for appliances
- Need: RD&D on crops that consume less water/low quality water
- Need: Develop water efficiency metrics

Infrastructure

- Need: Prioritize opportunities to increase water efficiencies throughout the system
- Need: Prioritize infrastructure needs based on areas specific to national interest
- Need: Identify water infrastructure needed under climate change scenarios
- Need: R&D on integrating non-dispatchable resources into the grid
    - Control systems, storage technologies, superconductors, DG integration models
- Need: Neutral evaluation/certification of new technology performance
- Need: Install turbines at existing reservoirs that do not have power generation
- Need: RD&D on advanced storage technologies
    - Flywheels, advanced superconducting batteries, compressed air, ice)

Climate change

- Need: Analysis of impacts of climate change and climate variability on hydropower resources
- Need: Understand and project potential impacts on water supplies
- Need: Develop and implement adaptive management, planning and mitigation approaches

These results are further elaborated in a summary overview document that compiles the problems, needs, and potential solutions identified and discussed for the Western Region.

Links to more detailed information and discussion can be found below in the matrix of workshop breakout group documentation. This information takes the form of Real-Time Notes, Flip Chart Summaries, and Problems and Needs Prioritization Tables. Breakout Group participants are also listed.

Workshop Breakout Group Documentation Matrix

BREAKOUT GROUP ATTENDANCE	NOTES	FLIP CHARTS	SUMMARIES	
			PROBLEMS	NEEDS

Group A	Group A	Group A	Group A	Group A
Group B	Group B	Group B	Group B	Group B
Group C	Group C	Group C	Group C	Group C
Group D	Group D	Group D	Group D	Group D
Group E	Group E	Group E	Group E	Group E
Group F	Group F	Group F	Group F	Group F

The Western Workshop Participant Survey indicates participant satisfaction and observations about features of the workshop. As part of the feed-back process, those who visit and make comments, suggestions, add references, etc., for the regional Energy-Water Workshop websites are tracked with a detailed site meter.

Next Steps

The results of the regional needs workshops provide input for technology gap analysis that is being accomplished during the February-March time-frame. The technical gaps analysis will then inform and be followed by a national energy-water workshop on Technical Approaches and Innovations to be held May 9-11, 2006 in La Joya, CA.

The information derived from this overall information gathering and analysis process will then be organized and integrated into an Energy-Water Technology Roadmap Report that will be peer reviewed and published by DOE at the end of FY2006. The roadmap will provide findings and recommendations to help guide future DOE Energy-Water Program technology development and investment priorities for addressing energy-water needs at local, regional, and national levels. The overall roadmap process and schedule was shown earlier in Figure-1.

Acknowledgments

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